

AIT CASE STUDY COVER SHEETStudent Name + TU ID: Evan Lyle (ID: 0619167 515)Semester: Fall 2023Case Study Title: Pool Club Management ApplicationAdvisor Name: Prof. Jal Irani**Course:**

- ☐ AIT 710
- ☐ AIT 715
- ☐ AIT 720
- ☒ AIT 725
- ☐ AIT 730
- ☐ AIT 735
- ☐ AIT 740
- ☐ AIT 745

Abstract:

Do you know how disorganized pool clubs really are? Pool operations are often mishandled, whether due to staff shortages, staff turnover, underspending or overspending on resources like chemicals, being unprepared for local health inspections, or even simply losing track of metrics such as the pH level or alkalinity. Such behavior needs to be rectified. This project will focus on developing an application for managing a pool club database with a functional and user-friendly interface. The resulting application will allow you to add, edit, and remove various chemicals and staff members (system users, lifeguards, and other employees); schedule different duties among the staff members; and monitor and track the water quality in the pool. It will also track the amount of pool chemicals in-stock.

The main programming language will be Python, with Python tkinter being used for the GUI, Python unittest in order to test the Python code, and GitHub being used for configuration management in order to store different versions of the code. The database itself will be written and stored in MySQL, with the MySQL Connector/Python tool allowing for the Python interface to interact with MySQL.

Past Courses: Please list all course completed and currently taking. Remember that you must complete all prerequisites in order to register for a case study.

<i>Number</i>	<i>Name</i>	<i>Semester</i>	<i>Grade</i>
AIT 600	Information Technology Infrastructure	Fall 2020	A
AIT 610	Systems Development Process	Fall 2020	A-
AIT 616	FUND WEB TECH/DEVELOPMENT	Spring 2021	A
AIT 624	Software Engineering Fundamentals	Spring 2021	B+
AIT 613	Introduction to Software Security	Fall 2021	A-
AIT 618	Client/Server-side Programming on the Web	Fall 2021	A
AIT 620	Business Data Communications	Spring 2022	A
AIT 632	Database Management Systems	Spring 2022	A
AIT 641	Software Requirements Engineering	Fall 2022	A
AIT 642	Software Testing and Maintenance	Spring 2023	B+

FOR OFFICE USE ONLY

Proposal Approved:

Report Received:

Pool Club Management Application

Problem Description

There is a need to develop an application to assist in swimming pool club management using modern technologies such as Python and MySQL. Too many pool clubs around the country have been plagued with mismanagement, causing irregular hours for pool staff and the management of chemicals (like the pH levels) to be ignored. Many pool clubs exceed their budget due to overusing pool chemicals, running short of pool chemicals, and mismanaging lifeguard scheduling. Additionally, pools are frequently inspected by local health departments. Many times, pools are not prepared for these inspections due to incomplete or missing documentation concerning water testing and licensing certifications resulting in temporary closure. The goal of this project is to create a database using modern technologies to keep track of complex pool tasks, water quality, maintenance, documentation, and scheduling so that financial and staff availability concerns will become a thing of the past.

The objective of this project is to provide an application that helps to keep track of your resources. For example, monitoring and tracking levels of chlorine and pH on a daily basis and total hardness, total alkalinity, and cyanuric acid levels on a weekly basis. For pool maintenance these include the amount of chemicals used versus the amount of chemicals that are in-stock; the ability to track and input the amount and type of chemicals recently purchased/stocked; and reminders of which chemicals need to be restocked based on scheduled use and if chemicals fall below a certain threshold. Another function of the database is the ability to add, edit, delete, and schedule for lifeguards and employees to oversee and manage the pool.

By the end of this project, the following deliverables will be presented:

- Requirements documentation,
- Database ER diagram,
- The use case diagram,
- The user interface diagram,
- The application's source code,
- A user manual,
- The scripts and tools for creating the project, and
- The final presentation and its recording.

Justification of the problem

I plan to use all the skills that I have learned across my AIT courses as it relates to software engineering. These include my experience with learning how to create the appropriate documentation for understanding the system at different levels of development, inputting, organizing, and editing the data in the proper format, and how to connect a database to a GUI interface. I shall also demonstrate the use of GitHub, showing how I can keep track of different versions of the project. I believe this project is worthy of the case study since all of those skills demonstrate how technology is a great asset for keeping track of resources and scheduling as long as it is planned out and constructed properly.

There are a number of learning opportunities tied to this project. First, I will learn how to integrate Python code with MySQL databases. This is done from the belief that learning about cross-language and cross-platform communication is useful so that certain functions already completed in one language can be reused in the context of another language or platform. This saves the software engineer time that would have otherwise been wasted on recreating certain features from scratch. It also helps one better understand how different types of software can communicate with one another in order to avoid compatibility issues. I will also learn how to craft a GUI interface using Python tkinter, a part of Python I have not yet interacted with, but I feel would be useful given the demand for Python that I have seen in various job announcements online. In addition, I would like to work on a project involving the Python programming language due to said previous demand for it.

As for the scope of the project and the size, I believe it is appropriate for a graduate case study project due to the involvement of system integration between different software tools and technologies that allow the application to fully unleash its true potential. It is also a worthy project since pool maintenance has a lot of moving parts and different variables attached to it depending on whether or not you have a public or private pool, much like how different maintenance operations have different needs and data needing to be managed depending on the type of maintenance being tracked.

Preliminary Design Plan

Use Cases and Use Case Diagrams

1. User login
2. Add, edit, or remove staff from the system.
 - a. Pool Manager
 - b. Pool Operator/Lifeguard
 - c. Lifeguard
 - d. Employee
3. Schedule maintenance
4. Add, edit, or remove daily readings.
 - a. Chlorine
 - b. pH
5. Add, edit, or remove weekly readings.
 - a. Total hardness
 - b. Total alkalinity
 - c. Total cyanuric acid levels

6. Generate report of chemicals required to meet regulatory levels.
 - a. Record amount of chemicals actually added to the pool.
7. Add, edit, or remove supply of pool chemicals.
8. Generate and view daily and weekly logs.
9. Add, edit, or remove lifeguard/employee schedules.
10. Generate and view schedules.

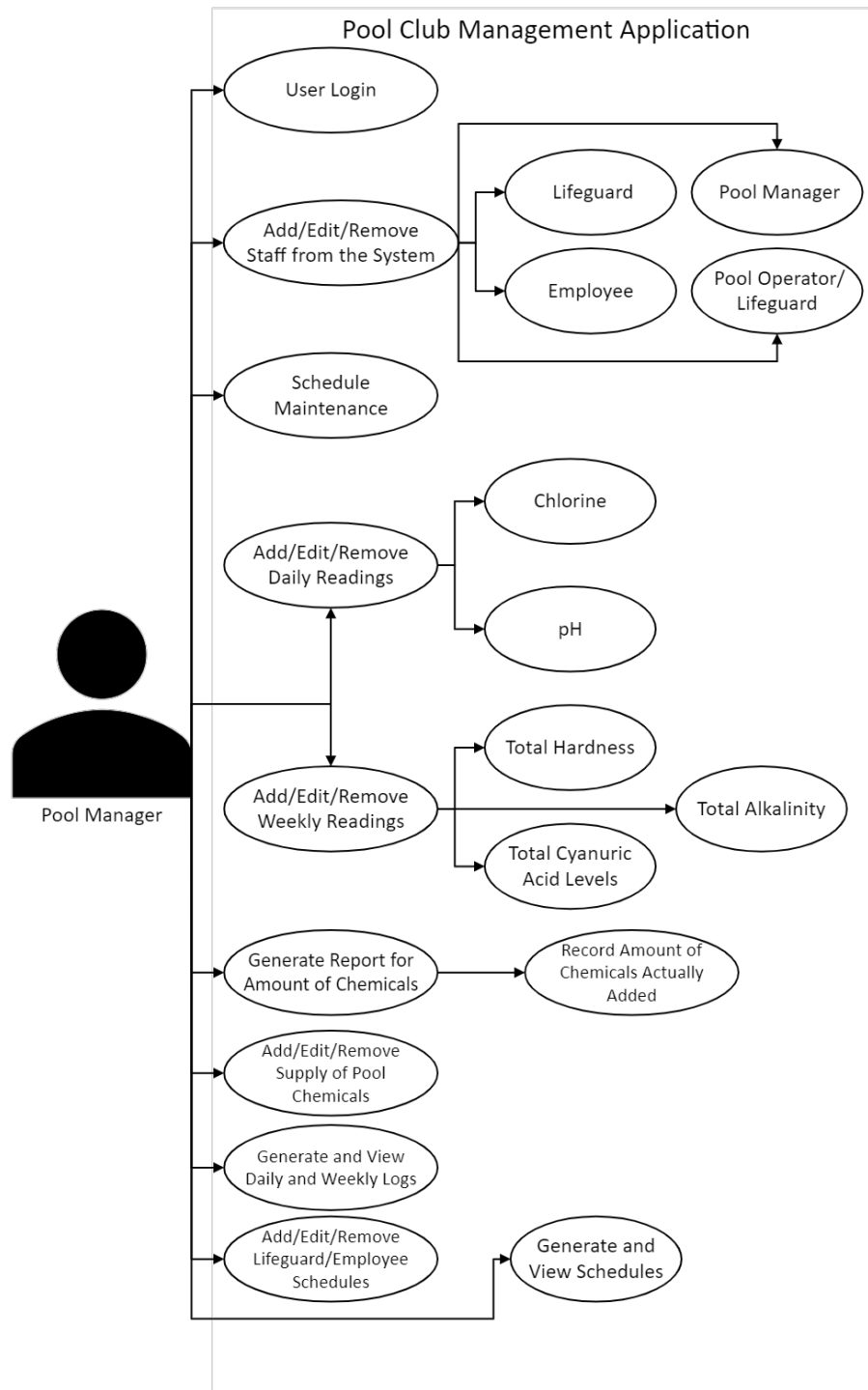


Figure 1 Pool Manager Use Case Diagram

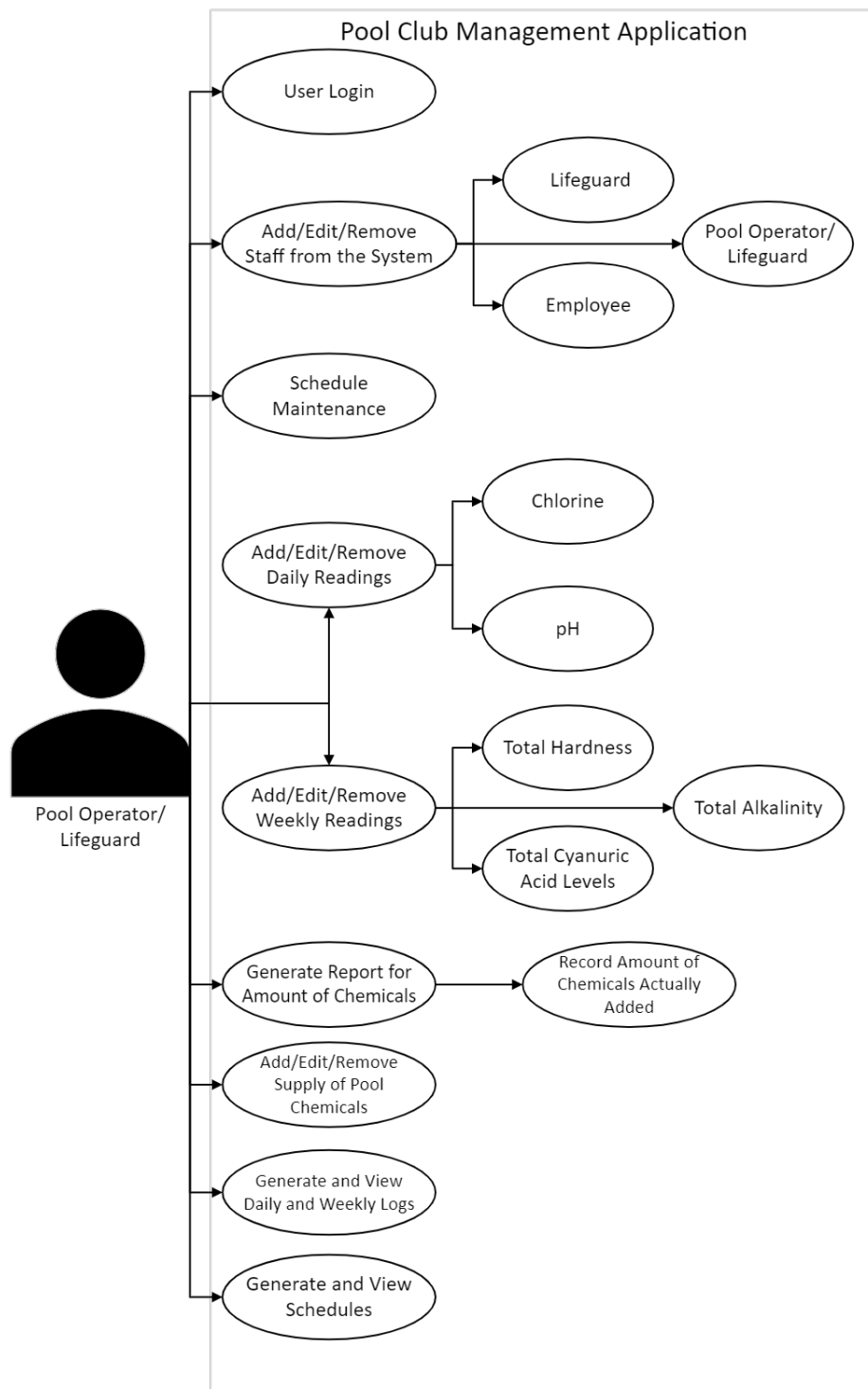


Figure 2 Pool Operator/Lifeguard Use Case Diagram

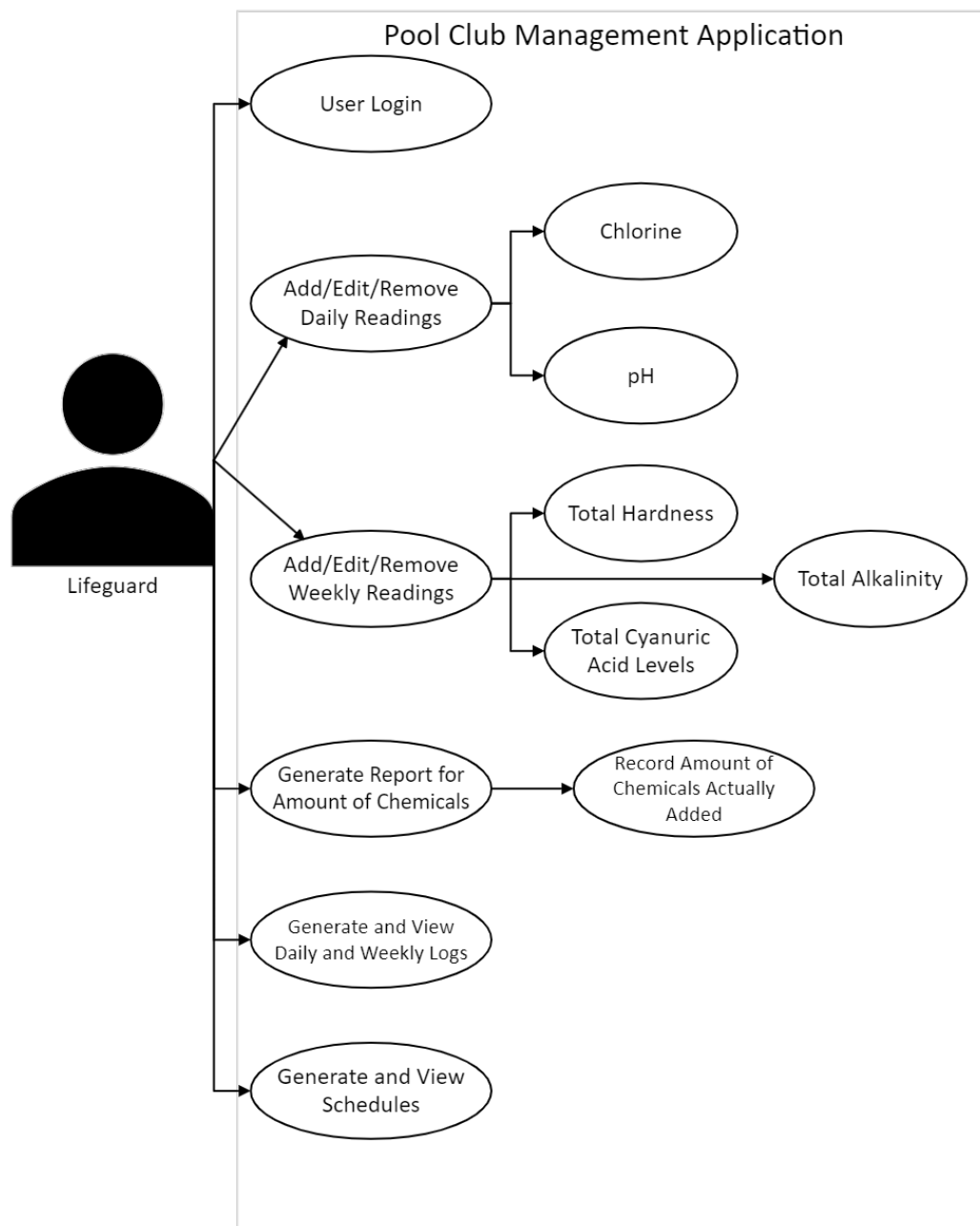


Figure 3 Lifeguard Use Case Diagram

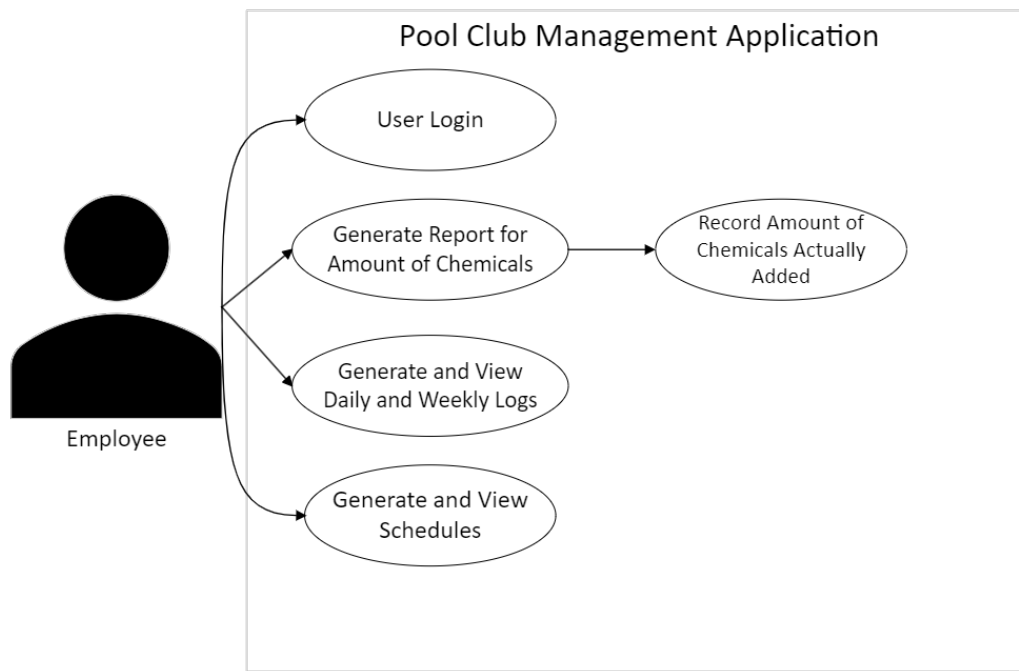
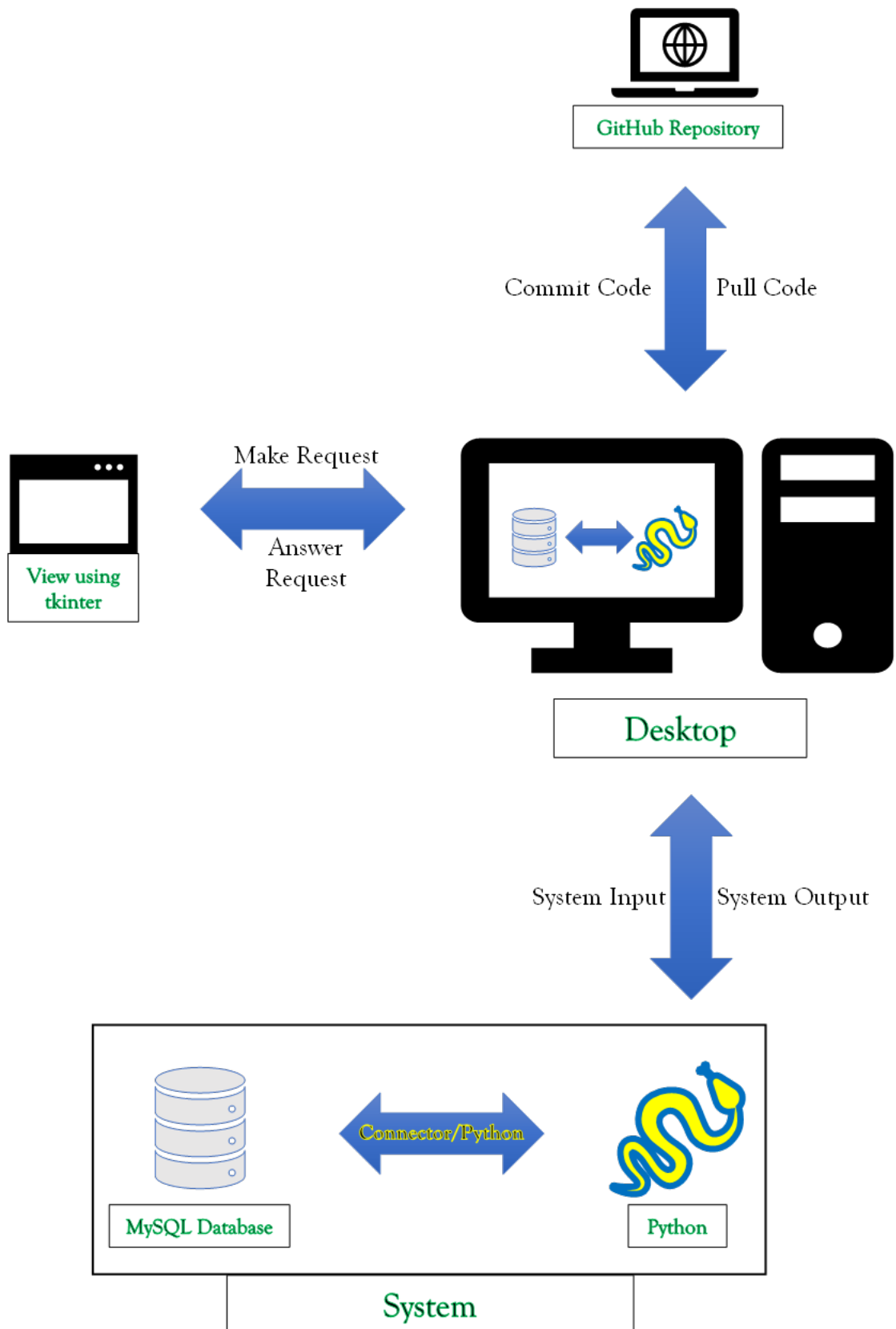


Figure 4 Employee Use Case Diagram

Preliminary Technology Framework/Platform

Technology	Purpose	Description
Python	The main coding language that the program will be written in.	A common and reliable programming language.
Python tkinter	Used in the creation of a Python GUI interface.	Python's GUI interface editor.
Python unittest	Used to test the Python code for different inputs.	A testing framework/platform for Python, much like JUnit is for Java.
MySQL	Used to build the database and where it is stored.	A database management software.
MySQL Connector/Python	Used as a bridge between the MySQL database and the Python GUI interface.	A connector tool allowing MySQL and Python to communicate.
GitHub	Used for configuration management (storing different versions of the same code in a repository).	An online repository for sharing and editing different versions of the same code base.

Preliminary Architectural Plan



Preliminary Schedule

Provide a preliminary schedule. The schedule needs to be at least 140 hours. The schedule needs to be granular and should contain activities related to regular meetings with faculty advisor.

Activities	Estimated Time (in hours)	Dates
Requirements and Research	10	08/28/2023
Setup Development Environment	10	09/04/2023
Advisor Meeting #1	1	09/11/2023
Defining Database Schema	10	09/11/2023
Create the Entity Relationship (ER) Diagram	8	09/18/2023
Advisor Meeting #2	1	09/25/2023
Analyze & Define Processes	10	09/25/2023
User Interface Diagram	8	10/02/2023
Advisor Meeting #3	1	10/09/2023
Design Code Modules	10	10/09/2023
Coding	10	10/16/2023
Advisor Meeting #4	1	10/23/2023
Coding	10	10/23/2023
Coding	10	10/30/2023
Advisor Meeting #5	1	11/06/2023
GUI Interface Mockup	8	11/06/2023
UI Code	10	11/13/2023
Unit and System Testing	10	11/20/2023
Advisor Meeting #6	1	11/27/2023
User Manual	8	11/27/2023
Case Study Draft Report	10	12/04/2023
Case Study Final Report due and Deliverables turned in		12/12/2023
Final Presentation and Presentation Recording	1	12/15/2023
Total	149	

Reading list

- [1] GitHub, “Let’s build from here,” GitHub, [Online], <https://github.com/> (accessed Jun. 27, 2023).
- [2] L. Barbosa and A. Hora, “How and Why Developers Migrate Python Tests,” in *2022 IEEE International Conference on Software Analysis, evolution and reengineering (saner)*, 2022, pp. 538–548
- [3] MySQL.com, “MySQL Connector/Python Developer Guide,” MySQL, [Online], <https://dev.mysql.com/doc/connector-python/en/> (accessed Jun. 28, 2023).
- [4] Python Software Foundation, “Python 3.11.4 documentation,” 3.11.4 Documentation, [Online], <https://docs.python.org/3/> (accessed Jun. 28, 2023).
- [5] Python Software Foundation, “tkinter - Python interface to TCL/Tk,” Python documentation, [Online], <https://docs.python.org/3/library/tkinter.html> (accessed Jun. 28, 2023).
- [6] Python Software Foundation, “unittest — Unit testing framework,” Python documentation, [Online], <https://docs.python.org/3/library/unittest.html> (accessed Jun. 27, 2023).
- [7] M. Reichardt, M. Gundall, and H. D. Schotten, “Benchmarking the Operation Times of NoSQL and MySQL Databases for Python Clients,” in *IECON 2021 - 47th annual conference of the IEEE industrial electronics society*, 2021
- [8] B. A. Meier, *Python Gui Programming Cookbook: Develop Beautiful and Powerful GUIs Using the Python Programming Language*, Second. Birmingham, UK: Packt Publishing, 2017.

I, _____*Evan Lyle*_____ propose to complete this project during the __*fall*__ semester of __*2023*__ and understand that this project and its derived materials (e.g., source code, written reports, presentation slides) are to reflect my own work, unless explicitly and appropriately referenced. Furthermore, I understand that plagiarism or other unattributed use of material not written by me is completely unacceptable, and **will be considered sufficient cause for a failing grade on the project.** For additional information on academic integrity policy at Towson University, I will visit www.towson.edu/provost/resources/studentacademic.asp.

Student's Signature: *Evan Lyle*

Instructor's Signature: *[Signature]*

Graduate Program Director's Signature: _____